UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

FOURTH CONSULTATION ON THE CAPITAL GOODS INDUSTRY WITH EMPHASIS ON MACHINE TOOLS

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REPORT

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PREFACE

The System of Consultations is an instrument through which the United Nations Industrial Development Organization (UNIDO) serves as a forum for developed and developing countries in their contacts and discussions directed towards the industrialization of the latter countries. Participants in the Consultations include government officials, as well as representatives of industry, labour, consumer groups and others, as deemed appropriate by the Governments concerned. The System facilitates negotiations among interested parties, at their request, either during or after the consultation meetings.

Benefits deriving from this activity include the identification of obstacles to industrial development in developing countries; the monitoring of trends in world industry with a view to identifying action-oriented measures for increasing the industrial output of developing countries; and the search for new forms of international industrial cooperation in North-South and South-South relations.

Since the inception of the System 1/ in 1975, Consultations have been held on the following industries and topics: agricultural machinery, building materials, capital goods, electronics, fertilizers, fisheries, food-processing, industrial financing, iron and steel, leather and leather products, non-ferrous metals, petrochemicals, small- and medium-scale enterprises, the training of industrial manpower, vegetable oils and fats, and wood and wood products. The System brings together sectoral decision-makers to deliberate on and propose concrete measures to accelerate the process of industrialization in developing countries. It has generated many innovations, particularly with respect to technological alternatives, integrated development and contractual arrangements. The many opportunities thus provided have led to the implementation of projects in technical assistance, investment promotion and technology transfer.

The Consultation process, by virtue of its consensual and normative character, has revealed itself to be an efficient vehicle for fostering cooperation. It is eminently suited to assist member States in the formulation of strategies and policies for industrial development.

The System of Consultations operates under the continuous and close guidance of the Industrial Development Board of UNIDO. In addition to undergoing annual reviews and occasional progress appraisals, the System was subjected to an in-depth evaluation in 1989, which concluded that it was making a major contribution to the development and formulation of UNIDO policies and programmes in specific sectors through integration and interaction with the other main activities of UNIDO.

1/ See Report of the Second General Conference of the United Nations Industrial Development Organization (ID/CONF.3/31), chap. IV, "The Lima Declaration and Plan of Action on Industrial Development and Co-operation", para. 66.

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INTRODUCTION

1. The Fourth Consultation on the Capital Goods Industry with Emphasis on Machine Tools was held at Prague from 16 to 20 September 1991. The Consultation was attended by 98 participants from 35 countries and 4 intergovernmental organizations (see annex I).

2. The Consultation was organized by the United Nations Industrial Development Organization (UNIDO) and hosted by the Government of the Czech and Slovak Federal Republic.

Background to the Fourth Consultation

3. The Industrial Development Board, at its fourth session, held in October 1988, decided to include the Fourth Consultation on the Capital Goods Industry with Emphasis on Machine Tools in the programme of Consultations for the biennium 1990-1991. 1/

4. Preparatory work began with a review of UNIDO technical cooperation and other projects and of institutions related to the capital goods industry in general and the machine-tool industry in particular. Based on that assessment, the UNIDO Secretariat carried out studies on the world machine-tool industry as well as regional and country surveys. The aim of these studies was to highlight trends in the industry with regard to policies, production, consumption, trade and technology, and the implications of those trends on industrial development in developing countries.

5. Also in preparation for the Fourth Consultation, a Regional Expert Group Meeting was convened at Santiago, Chile, from 8 to 11 April 1991. This meeting was organized by UNIDO with the cooperation of Sistema Económico Latinoamericano (SELA) and the Economic Commission for Latin America and the Caribbean (ECLAC), and was attended by 29 participants, two observers and representatives of SELA and ECLAC.

6. The Expert Group Meeting recommended that the Fourth Consultation on the Capital Goods Industry with Emphasis on Machine Tools should discuss conditions of entry and measures to promote competitive local production and the effective utilization of machine tools. This subject should take into account the following aspects:

(a) Stable, favourable industrial policies;

(b) Plans for financing in regard to investment, trade and technological innovation;

(c) Marketing strategies and entrepreneurial policies;

(d) Human resource development;

(e) Acquisition and promotion of machine-tool technologies;

1/ "Report of the Industrial Development Board on the work of its fourth session" (GC.3/2), annex I, IDB.4/Dec.8.

(f) Complementary aspects of production and regional cooperation;

(g) Industrial reorganization related to the use of advanced technology machine tools;

(h) User-producer relations.

AGREED CONCLUSIONS AND RECOMMENDATIONS

7. Among the large variety of capital goods, machine tools occupy a special position since they are used to manufacture other capital goods. Despite its relatively small size, the machine-tool industry plays a strategic role in economic and industrial development. All countries of the world are users of machine tools. Therefore, the optimum utilization of machine tools is universally important. Moreover, the strategic nature of the machine-tool industry arises from its role as a supplier of continuously improved manufacturing technologies, thus contributing to industrial productivity.

8. The recognition of the strategic importance of the machine-tool industry in the leading producer countries has often justified government intervention in the form of supportive industrial policies and/or direct investment. However, in many countries that have entered the sector, this recognition has not always led to the adoption of stable favourable policies for the industry. The success of the industry depends upon the existence of several prerequisites such as markets, skilled personnel, supportive industries, adequate infrastructure and appropriate industrial policy. The industry's strategic importance, therefore, is not always a sufficient reason for developing countries to enter this sector.

9. The sector covers a wide range of products from machine tools incorporating simple technology up to equipment incorporating advanced technology, a fact that, in view of the differing needs and levels of the industrial structure of developing countries, opens up realistic prospects for seeking solutions appropriate to different situations.

10. The manufacturing of machine tools and their utilization in industry should be viewed in a realistic manner and on the basis of the specific technical and economic conditions of each country. As a general rule, however, the progressive utilization of automation techniques should make it possible for industrial enterprises to achieve: gains in productivity and efficiency; better product quality and product mix; and a decrease in costs.

11. Prudence has to be exercised before entering headlong into this industry, preferably applying a gradual approach starting with repair and maintenance and the production of spare parts and proceeding to the production of tools, jigs, fixtures and dies to assembly and, finally, to the actual manufacture of machine tools, supported by accurate and realistic feasibility studies. The most important element in this evolutionary process is the building-up of human capabilities and the infrastructural environment. It is therefore recommended that developing countries, both at the national and enterprise level, take special care in elaborating programmes for human resource and infrastructure development to ensure the success of this industry.

12. It is also recommended that, in order to assist developing countries entering this industry, UNIDO should:

(a) Continue to undertake studies and field analysis in developing countries with a view to identifying certain common features and policy issues that would be required for the introduction, implementation and eventual production of machine tools in those countries;

(b) Improve its monitoring capacity in the machine-tool sector in both developing and developed countries;

(c) Intensify its work in the field of international cooperation, fostering flows of technologies from developed to developing countries and also encouraging South-South cooperation.

Policy measures

13. Major policy issues that concern the success or failure of this industry include the following:

(a) Trade policy. It is recognized that the machine-tool industry is extremely sensitive to cyclical development and to trade. About 50 per cent of the machine tools produced worldwide are traded internationally. Thus trade policies with regard to import and export are crucial to the success of the industry. While strict protective measures may stale the technological development and international competitiveness of the industry, too much liberalization may lead to the destruction of nascent national industry. Governments of developing countries should resort to policies that will encourage the flow of technology and may compensate local producers by other supportive measures. Developed countries, in the meantime, should lift undue restrictions on imports of machine tools from developing countries. Regarding the advantages and disadvantages of importing second-hand machine tools, it is necessary to weigh the balance between saving on foreign currency and the loss of flow of the latest technology. Local requirements and conditions would be the main determinant of such a policy;

(b) Industrial policies and other policies. Since the machine-tool industry is very sensitive to technological development, it is often the practice that government agencies offer support to research and development activities aimed at the development of this sector. Thus Governments of developing countries producing machine tools are recommended to take the above-mentioned measures in support of this sector. International and regional organizations, such as UNIDO, should offer special support in the elaboration of policy guidelines that could be adopted by developing countries, containing a package of policy incentives at the sectoral and macro-level that would be needed to support the development of the machine-tool sector, especially in the early stages of its development. Among the important policy incentives that could be undertaken by Governments are those related to the procurement policies of the public sector where special preference could be given to nationally produced machine tools. Another policy issue that is important not only on a national level, but also on a subregional and regional level concerns the development of standards and specifications that facilitate the exchange of components and equipment and encourage trade. It is thus recommended that national and regional institutions deal with these aspects and with the research and development activities related to them;

(c) Financing. The availability of commercial financing is dependent on the viability of investment projects. The availability of concessionary financing is dependent mainly upon national government policies encouraging the establishment or rehabilitation/modernization of capital-goods production units and supporting research and development activities in the sector. Such policy objectives usually entail the Government subsidizing the commercial rates charged by national development finance institutions. The viability of investment projects, which is an important prerequisite for obtaining commercial financing, is itself dependent on a number of factors, the most important of which are the availability of a market, raw materials and adequate skills at competitive prices. The involvement of industrialists at

an early stage in the preparation of investment projects is extremely important to their successful realization. With regard to modes of financing, although leasing is one of the non-traditional mechanisms suitable for the financing of capital goods projects, it has only recently been introduced in developing countries.

14. It is therefore recommended that:

(a) Developing countries should take the necessary legislative and fiscal measures to introduce non-traditional financing mechanisms, especially leasing through, inter alia, the establishment of national financing companies in which the private sector would play a major role. Such companies could be established through international cooperation, especially joint ventures with international and regional development finance institutions and specialized firms;

(b) The international organizations concerned should intensify their technical cooperation activities in assisting developing countries in the establishment of non-traditional financing firms with a view to facilitating the development of the capital goods industry.

Human resource development and mastering of technology

15. The human resource development requirements of machine-tool users and producers have changed considerably. In particular, the introduction of computer numerical control (CNC) machine tools has revealed the inadequacy of traditional training programmes since it necessitates the training not only of machine operators, but also of software specialists, programmers, tool setters and maintenance personnel. Training should not be limited to technical personnel only, but should also include the staff responsible for the selection, design and procurement of machine tools, for the adaptation of organization and production methods and for the setting up of management and quality systems (standardization, metrology, certification procedures etc.).

16. It is therefore recommended that UNIDO and other competent organizations should assist developing countries in the establishment and/or strengthening of national training centres or institutes, putting special emphasis on advanced technology machinery and using modern teaching means and methods such as simulators, computer-aided instruction (CAI) packages etc., as well as in the promotion of regional cooperation between such training institutes, as provided in the Regional Programme on Industrial Automation of the Capital Goods Sector in Latin America.

17. Finally, it is recommended that Governments and international organizations should provide assistance to enterprises and industrial research and development institutions in their efforts towards the adaptation and development of technologies in the capital goods sector.

Total quality control and standardization

18. Considering that total quality control and standardization are absolutely essential for machine-tool production, it is recommended that UNIDO should assist manufacturers in developing countries in promoting total quality-control systems and in their efforts to apply standards to their products and processes.

Utilization of machine tools

19. Owing to the high cost of advanced technology machine tools, their full utilization constitutes a crucial issue in their introduction in developing countries. The proper utilization of machine tools in general, and of advanced technology machine tools in particular, is possible only if:

(a) Machine operators, software programmers and tool setters are trained;

(b) Machine tools are regularly maintained and/or repaired when required by maintenance and repair specialists who are trained to carry out these tasks;

(c) Machine tools are supplemented by the tools, jigs, fixtures and dies as required by the workpiece being machined;

(d) Work organization and production planning schedules are established.

20. It is therefore recommended that the establishment of machine-tool research and development centres or institutes should be promoted to introduce modern machine tools, their accessories and their proper utilization in developing countries.

Social impact of introducing advanced machining technologies

21. The main issue concerns the impact on employment in the engineering industries. Although the introduction of advanced machining technologies has a labour-saving effect at the shop-floor level, it does create new employment in other related activities within and outside the enterprise where the new equipment has been introduced. By the proper management of human resources at the enterprise level, difficulties that may arise when automation equipment is introduced can be largely counterbalanced. At the sectoral level, the introduction of advanced machining technologies in the engineering industries does not have a negative impact on the employment level in industrialized countries, and is not likely to do so in the developing countries. On the contrary, lack of competitiveness owing to low productivity can lead to a reduction in the number of industrial jobs.

22. The introduction of advanced machining technologies does not have a de-skilling effect at the operator level. On the contrary, new skills will be acquired by the operator, notably those related to computer controls, thereby increasing the level of the industrial culture of the population.

Environment

23. The machine-tool and supporting engineering industries involve industrial processes that could have adverse impacts on the environment if adequate precautions are not taken. Waste management and control is an important consideration in all engineering industries including the machine-tool industry. The steadily growing awareness of environmental considerations in industrial development extends increasingly to the capital goods industry, which is being directed more and more to the production of equipment for the control and abatement of pollution, as well as to the recycling of materials and to energy conservation.

24. Environmental management calls for economic and regulatory mechanisms, public awareness and training, and research and development in cleaner

technologies and demonstration projects. Both government funding and international cooperation would be needed in particular to deal with existing plants. In this context, the Consultation takes note of the Conference on Ecologically Sustainable Industrial Development being organized by UNIDO in Copenhagen in October 1991.

25. For the improvement of the environment, the polluter-pays principle is just as applicable to the capital goods industry as it is to other sectors. Special efforts for the development of new technologies to improve environmental control and monitoring should be undertaken, including the development of appropriate equipment. Particular efforts, both in the application of technology and in the diffusion of information, should be concentrated on small- and medium-scale enterprises. Developed countries should transfer the know-how of such processes to developing countries, and to small- and medium-scale enterprises regarding the acquisition and use of equipment for the environmental management of their industrial processes.

International cooperation

26. International cooperation is of paramount importance in order to strengthen and upgrade the capabilities of different countries and regions for the production and utilization of capital goods, including machine tools. A regional and integrated approach can offer new opportunities for increasing economic, financial and industrial cooperation.

27. This approach has been adopted with success in the Latin American context, where a Regional Programme on Industrial Automation of the Capital Goods Sector has been recently launched by UNIDO with the aim of strengthening further international technical cooperation between the private sectors of several industrialized countries and Latin American enterprises. The aim is to make full use of the experience, installed capacities, programmes and projects under way, as well as the centres of excellence existing in the sectors linked with the capital goods industry.

28. It is therefore recommended that new forms of international cooperation schemes should be identified to foster and increase the flow of new technologies to developing countries, which are users or producers of capital goods including machine tools. The integrated approach, formulated by UNIDO in the Regional Programme on Industrial Automation of the Capital Goods Sector in Latin America, should be considered by other developing regions such as Africa and Asia. It is also recommended that action should be taken to strengthen cooperation between more advanced developing countries and less developed ones.

I. ORGANIZATION OF THE CONSULTATION

Opening of the Consultation

Statement on behalf of the Director-General

29. In the opening statement, presented on behalf of the Director-General of UNIDO, the Deputy Director-General, Department for Industrial Promotion, Consultations and Technology, said that the Consultation was taking place in a historical period characterized by rapid economic reforms in many countries and particularly developing countries. Indeed, industrial restructuring programmes, privatization and market-oriented strategies had become the catchwords for development planners across the globe. As countries underwent that metamorphosis, new problems and opportunities emerged. Therefore, cooperation between countries at the regional and international levels had become imperative in seeking solutions to numerous development problems and in exploiting the new opportunities aimed at accelerating socio-economic development. The Deputy Director-General said that UNIDO was committed to continuing to play a catalytic role in those changing circumstances within its mandate of promoting industrial development in developing countries. Thus, the System of Consultations was an important instrument by providing an international forum in which to discuss the constraints to the development of key sectors and to propose measures to resolve them. He then underlined the importance of the capital goods sector, which was at the core of the industrialization process since it provided the machines that were essential for industrial production; the ability to produce capital goods imparted a strategic advantage to the producing countries.

30. He said that the production of capital goods required machine tools and that although the machine-tool industry constituted a very small part of the capital goods sector, it was none the less extremely important. It was necessary for each country to consider whether it should begin producing machine tools or resolve to become a user. Relevant questions that needed to be addressed related to: the specific advantages that could be obtained by engaging in machine-tool production; the conditions of entry into that industry; and the ability to meet those conditions in the short or medium term. Furthermore, in the light of the increasing liberalization of trade and the relaxation of restrictions on imports, countries that had entered the sector were having to face the problem of how to sustain competitiveness.

31. The Deputy Director-General concluded by mentioning some UNIDO technical cooperation activities in the capital goods sector. One was a major programme for the industrial recovery of Latin American countries. Its aim was to increase the competitiveness and productivity of producers, and the number of users, of capital goods in Latin American countries. Another major programme was in progress in China.

Statement by the Director of the System of Consultations Division

32. In welcoming the participants, the Director of the System of Consultations Division began by stating that the Consultation had been organized within the framework of the UNIDO System of Consultations, a programme created in 1975 on the recommendation of the Second General Conference of UNIDO held at Lima, Peru. The Director observed that the aim of each Consultation was to make recommendations that seemed operationally useful for the development of a particular sector through international cooperation. He emphasized that

international cooperation remained the only viable and desirable alternative if what was being sought was not only industrial growth, but also economic development in an atmosphere of peace and harmony between nations, which was what UNIDO wanted to offer through the System of Consultations.

Statements on behalf of the Government of the Czech and Slovak Federal Republic

33. The Consultation was addressed by the Minister of Economy of the Slovak Republic on behalf of the Government of the Czech and Slovak Federal Republic. After welcoming the participants, the minister gave a brief historical account of the development of engineering industries in the country. He stated that engineering production had started in the eighteenth and nineteenth centuries, citing the iron works in Vitkovice and the Skoda plant in Pilsen as examples of pioneering facilities. Rapid development had been achieved, but after the Second World War a shift had occurred towards heavy engineering with an inefficient use of raw materials and energy. In the ensuing period, contacts with industrialized market economies had been minimal. In spite of these developments, the engineering industries had managed to penetrate the export market.

34. The minister said that the machine-tool industry was particularly export-oriented as demonstrated by the fact that whilst the share of the country in world production stood at 1.2 per cent, its share in world exports was 2.2 per cent.

35. He said that, in collaboration with foreign partners, a restructuring process of the engineering industry was in process, which included the reconversion of facilities such as those producing armaments. A liberalization of the export market was also being implemented. He described various cooperation activities that the country's firms could offer and stated that it was the wish of his Government to guide the country back to the family of advanced countries through modern production technologies, the development of infrastructure, and the intellectual and cultural potential of its population.

36. The Consultation was also addressed by a representative of the Ministry of Foreign Affairs. He referred to the continuing cooperation between UNIDO and his Government and stated that his country considered the System of Consultations to be an essential part of UNIDO activities and supported its further development. Indeed, the Czech and Slovak Federal Republic intended to be even more active in future Consultations organized by UNIDO.

Presentations on UNIDO activities in the capital goods sector

36. A representative of the UNIDO Secretariat described the Regional Programme on Industrial Automation of the Capital Goods Sector in Latin America. The Programme, which had been launched recently, aimed at addressing the deteriorating conditions of the capital goods sector in Latin America, brought about by, among other things, the economic crisis of the 1980s that had led to declines in investment. That factor, coupled with increasing international competition, had had a devastating impact on the development of the sector, which was characterized by underutilization of capacity, poor engineering capabilities, unsuitable business practices and industrial policies, structural problems and a poor image at the enterprise level. The Programme, which would run for three years, tackled those deficiencies by restructuring and modernization of the sector. He then described the anticipated quantitative output at the regional and national levels at the end of the Programme and acknowledged

those industrialized countries that had contributed to its financing. He called upon other countries to join UNIDO in ensuring its successful completion.

38. Another representative of the Secretariat presented an overview of UNIDO technical cooperation activities in the field of capital goods. He stated that UNIDO activities, in addition to Consultations, involved: technical cooperation; the identification and promotion of investment projects; industrial studies and information; training, and the development and transfer of technology. Some of the components of the UNIDO programme in the field of capital goods, including machine tools, were: collecting, compiling and disseminating information; identifying needs; promoting the formulation of policies and programmes through studies, workshops, seminars and advisory services; and promoting the design, development and manufacture of equipment and machinery through technical cooperation programmes.

39. He said that technical cooperation projects and programmes aimed at: product design, making prototypes, and reverse engineering; pilot production; production rationalization and automation; repair and maintenance of products and plants; and environmental monitoring and control. In designing, formulating and executing such projects, suitable technologies were selected from a wide range of available options. Those included conventional technologies on the one hand, and more modern ones, such as CNC-controlled machining, and computer-aided design and computer-aided manufacturing (CAD/CAM) etc., on the other hand. Advanced technologies such as computer-integrated manufacturing (CIM), flexible manufacturing system (FMS) and artificial intelligence and expert systems (AI/ES) were also utilized when the infrastructure and the environment of a specific project permitted.

40. Another representative of the Secretariat described the activities of the Industrial Investment Programme of UNIDO and said that links between the Programme and the Consultation manifested themselves especially in the area of entry into the machine-tool industry subsector. He explained how the Programme assisted industrialists in developing countries to identify, formulate and promote their investment projects, thereby enabling them to conclude business agreements for the purpose of obtaining the investment resources required for the implementation of their projects.

Presentation of the machine-tool industry in the Czech and Slovak Federal Republic

41. A participant from the host country gave an outline of the history of the machine-tool industry in the Czech and Slovak Federal Republic, its origins in the last century, and its growth and diversification into the production of a very wide range of conventional and advanced machine tools. The earliest engineering works in the country had begun manufacturing simple machine tools for their own needs as far back as the 1830s. Specialized grinding machines, drilling machines, lathes and horizontal boring machines were produced before the end of the nineteenth century. Machine-tool production in the country covered almost the entire range of metal cutting and metal forming machines. With the recent policital and economic changes in the country, the industry was opening to foreign investment and was active in the European Association of Machine Tools Manufacturers. Another participant from the host country outlined the activities of his company as a manufacturer and supplier of machine-tool equipment, and said that a large share of its exports was directed towards Africa, Asia and the Middle East, including the provision of plants

and training. Products included environmental equipment, industrial robots and FMS.

Election of officers

42. The following officers were elected:

Chairman: Jiri Paloumek (Czech and Slovak Federal Republic), Vice-President, Technoexport

Rapporteur: Masoya Magoti (United Republic of Tanzania), General Manager, Kilimanjaro Machine Tools Manufacturing Co.

Vice-Chairmen: Jagdish Pal Malik (India), General Manager, Hindustan Machine Tools

Joelle Ory (France), Chargée de mission aux affaires internationales, Ministere de l'Industrie et du Commerce Extérieur

Norberto Ticca (Argentina), Presidente, Asociación Argentina de Fabricantes de Maquinas Herramientas

Adoption of the agenda

43. The Consultation adopted the following agenda:

1. Opening of the Consultation
2. Election of Chairman, Vice-Chairmen and Rapporteur
3. Adoption of the agenda and organization of work
4. Presentation of the issue by the UNIDO Secretariat
5. Discussion of the issue: "Conditions of entry and measures to promote competitive local production and effective utilization of machine tools"
6. Drawing up of conclusions and recommendations
7. Adoption of the report

Adoption of the report

44. The report of the Fourth Consultation on the Capital Goods Industry with Emphasis on Machine Tools was adopted by consensus at the final plenary on 20 September 1991.

Documentation

45. The documents issued prior to the Consultation are listed in annex II.

II. REPORT ON THE DISCUSSIONS ON THE ISSUE PAPER: CONDITIONS OF ENTRY AND MEASURES TO PROMOTE COMPETITIVE LOCAL PRODUCTION AND EFFECTIVE UTILIZATION OF MACHINE TOOLS

46. A representative of the UNIDO Secretariat presented the issue to the Consultation, as set out in the Secretariat's paper entitled "Conditions of entry and measures to promote competitive local production and effective utilization of machine tools" (ID/WG.514/3). He drew attention to the diversity of products in the field and the need for firms to specialize in particular product lines. The reliance on supporting industries from the metallurgical and engineering sector was noted, as was the market orientation towards the metalworking sector.

47. Significant changes in world markets were outlined, as well as investment and technology trends. The latter, including CNC, FMS and trends towards CIM, were altering the basis of competition in industry and providing new economies of scope. He reviewed the constraints on and opportunities for the development of the machine-tool industry in developing countries, including the following: lack of sufficient domestic market, shortage of skilled personnel, lack of supporting industries, difficulties in technology acquisition, product-mix restriction and need to diversify, and inadequate industrial policies.

48. In the ensuing discussion, the issue of entry into production of machine tools was addressed. A participant summarized the history of capital goods production in his country. Some participants considered that the industry was very difficult to break into, and that it was important to distinguish between countries at different levels of development. With the wide range of possible equipment that could be produced, there was thus a dual diversity. A representative of the United Nations Conference on Trade and Development pointed out that, with respect to international trade, the degree of international specialization was very high. The value of developing country exports of machine tools was estimated to be $US 2 billion, which was approximately equal to that of the United States of America. However, only a few developing countries contributed to that total and the dependence of developing countries on imported spare parts remained high. He considered that protection, if applied, should be short-lived, transparent and based on tariffs. Entry into production could begin slowly, with production at modest levels or with production of spare parts, with a progressive dovetailing with development in other areas. Realistic solutions were needed and careful preliminary studies should be carried out. An integrated approach was necessary, which would consider training and maintenance aspects also, as well as reorganization needs. It was pointed out that the setting up of a national machine-tool industry was not the first necessary step in the industrialization of developing countries. Before entering the machine-tools sector, it was necessary to bear in mind that there was overcapacity in world production, owing to continuous innovation; developing countries should enter the industry only if the necessary preconditions were fulfilled.

49. Other participants nevertheless highlighted the desire of countries without a machine-tool industry, or with one in need of further development, to establish or to enhance domestic production of machine tools. Strategies based on the production of spare parts were not applicable when the diversity of requirements was too great and, in view of the shortage of skills in many cases, reverse engineering was often not an option. The additional obstacles cited included the lack of: basic infrastructure, support services, government encouragement and training, as well as underdeveloped subcontracting and the

problem of financial resources. Owing to a lack of confidence in the quality of the domestic products, there was sometimes considerable importation of spare parts.

50. With respect to government policies for the encouragement of a domestic machine-tool industry, the role of protectionism was referred to by some participants. The negative effects of protectionism were pointed out in that it led to outmoded products and high prices because of a lack of competition. There also had to be a balance between protecting the machine-tool industry and maintaining the competitiveness of the mechanical/engineering industry; uniform tariff protection was to be avoided.

51. The importance of developing human resources was recognized as central by all participants. The training needs included not only the necessary skills in operating capital goods, especially machine tools, but also management training, which should incorporate the necessary aspects of the specification, selection and acquisition of equipment. Automation, including the stage of NC machine tools, raised additional problems. The more that existing skills were out of line with the automation process, the more likely it was that problems would arise. The operation of NC machine tools required only a few months of operator training (compared with up to two years for the operation of traditional machine tools). Although the training period was shorter, the skills acquired were different and had to include familiarity with computer operation and peripherals. Additional skilled staff would also be needed, as well as operators, electronics technicians and programmers. The absence of available operators was cited as a reason for enterprises not acquiring high-level CNC machine tools. In another case, a company was unable to retain trained staff because better conditions were offered by the private sector.

52. It was suggested that training philosophies needed to be changed in order to meet the requirements for CNC machine-tool operators. The use of computer-aided instructions (CAI) was proposed. Furthermore, there must be a full commitment in the provision of technology to include training for trainers.

53. The question of training was also raised in connection with maintenance. To some extent, the skill requirements were paradoxically higher in developing countries owing to a shortage of financial resources and foreign exchange. For instance, the replacement of electronic components rather than assemblies was often necessary, which was a more demanding task. In general, the establishment of good maintenance facilities was seen as a precondition for entry into the production of machine tools, as well as being an initial stage of such production. The question of maintenance also arose with regard to marketing: a network of support dealerships was seen as being central to the successful sales of machine tools, and new entrants to the production of machine tools would have to take that factor into account.

54. The significance of markets for assessing the viability of machine-tool production in developing countries was stressed by several participants. At the same time, the question of markets could not be separated from that of product mix, and the need to avoid too restricted a range was emphasized. The need for an assured market for the products was of particular importance, which could partly be met, at least in the initial stages, by the use of government purchasing power, including also the purchasing activities of state-owned enterprises.

55. In connection with markets, the question of subregional cooperation was referred to by several participants. The process of economic integration in different subregions was referred to, and the opportunities thus afforded for wider markets in which the products of new entrants could be marketed. It was pointed out that, in one subregion, a potential market of 190 million people existed and that a machine-tool company currently in operation could form the basis of a machine-tool programme for the subregion as a whole. Again, in another subregion, it was pointed out that, while machine-tool production took place in some member countries, other member countries specialized in the production of components and spare parts. Thus as well as offering wider markets, subregional cooperation increased the possibilities for matching complementarities in machine-tool production and associated activities. Such cooperation also highlighted the necessity for standards, and the application of standards of the International Organization for Standardization was pointed out. Standards were also stressed in connection with quality requirements.

56. Detailed aspects of market analysis and development were discussed. It was pointed out that a network of agents was necessary within a given market, in order to provide demonstration, maintenance and support facilities. One participant pointed out that the informal sector was important in most African countries, accounting for a significant part of industrial production, and that it also had equipment needs. Some participants considered that the development of maintenance and support facilities was a first step towards production. Supporting industries were examined both as part of a strategy for the initiation or development of the machine-tool industry, and also as an autonomous phenomenon; they were seen as being a spin-off and as part of the evolution of the central industry. The employment-creation effects of the development of the machine-tool industry were noted. Job creation resulted from the stimulus given to the engineering and metalworking industries by a pattern of production or the increased use of machine tools. With respect to advanced technologies in industrial automation, job creation took place in the supporting industries for these technologies, including electronics, computer software and system integration. In one developed country, employment in the machine-tool industry itself had decreased in the last few years.

57. With respect to advanced technologies and their social implications, it was generally recognized that FMS called for a significant change in methods of work as well as high levels of investment and a very good knowledge of the technique involved. The need for developing countries to learn from the mistakes of developed countries was pointed out. FMS required a surrounding milieu of subcontracting firms, otherwise it would be too expensive to develop specifically. As for just-in-time (JIT) production methods, it was recognized that they were highly dependent for their success on the external environment, and would not work if the geographical distance to the suppliers was too great, or if the transport infrastructure was inadequate. It was stressed that these technologies were not directed towards mass production; but provided instead improved quality and flexibility.

58. In discussing environmental aspects, a representative of UNIDO outlined the growing awareness of environmental issues in the capital goods industry. Particular aspects included increased possibilities for the use of sensors to reduce environmental impact, as well as the question of recycling. In Latin America, the development of new equipment and devices for environmental control and improvement by local research and development institutes was an important issue. The lack of knowledge was one difficulty that was emphasized, specially for small-scale industries which, in general, did not know how to cope with

their effluents. Developed countries should transfer their knowledge in the design of suitable processes. A representative of a subregional organization expressed his support for the principle that the polluter pays. However, industrial pollution was not a problem in most of the member states of his organization, compared with deforestation. The preparations for the Conference on Ecologically Sustainable Industrial Development being organized by UNIDO at the ministerial level were outlined by a representative of UNIDO.

59. Regarding financing the production and acquisition of capital goods, a number of mechanisms were considered. The provision of concessionary finance for acquiring capital goods, by means of subsidized loans from development finance corporations, was reviewed. An alternative mechanism, that of leasing, was also examined. It was recognized that, although the method was not widely known in developing countries, it nevertheless offered considerable possibilities. A delegate from an international financing institution outlined his organization's experiences with non-traditional financing methods, which extended back over 15 years. The leasing method had been applied to 43 industrial projects with a total value of $US 1 billion. In some cases, however, the legislative framework for leasing did not exist in developing countries. A representative of UNIDO pointed out that leasing companies could be set up in cooperation with experienced international firms, and that UNIDO could also provide assistance.

60. A representative of the host Government presented a paper entitled "Strategic position of Czechoslovakia in Eastern Europe", in which he highlighted policies for restructuring the economy towards a market-oriented system and a programme entitled "Return to Europe". The programme was aimed at reversing the unfavourable economic evolution that had occurred in the period from 1948 to 1989. He said that the main elements of the programme included the rapid privatization of small and large business operations, the conversion of military production units into those with civil applications, the elimination of social employment, tax reform and the creation of favourable conditions for increased inflows of foreign capital into the economy of the host country. He reported on the achievements attained and the projections anticipated. The presentation was commended by several participants, who urged that copies of the paper be widely distributed.

61. The following statement was distributed by the participants from Latin American countries:

> "On behalf of the Latin American private-sector producers and users of machine tools, in particular, and of the Latin American capital goods industry in general, we would like to express our thanks to UNIDO for the invitation to participate in the Fourth Consultation on the Capital Goods Industry with Emphasis on Machine Tools.
>
> "This participation is taking place in the context of the regional industrial automation programme for the capital goods sector, a very welcome programme which UNIDO has begun to implement, and from which the Latin American private sector, as the direct counterpart, will derive great benefits. We are convinced that the objectives and the results and activities envisaged during the initial phase of the regional programme are in line with the needs and priorities of the region. For the Latin American production

sector, the modernization of industrial equipment is an urgent necessity.

"We also believe that the regional programme, in maintaining links with private enterprises, entities and institutions in the industrialized countries, will become a tool for facilitating inter-enterprise co-operation, investment promotion, joint ventures and the transfer of new technologies to the enterprises of the countries in the region.

"We should like to congratulate UNIDO on the initiation of activities under the regional programme in the Institute of Engineering at Caracas, Venezuela, and assure this organization once again of our full support in the pursuit of the goals proposed. We wish to express our thanks to the donor countries that have contributed towards the financing of the regional programme, namely Venezuela, France, Italy, Switzerland and Japan, and we should like to invite other industrialized countries to associate themselves actively with the regional programme so that we may unite our efforts directed towards the re-industrialization of Latin America."

Annex I

LIST OF PARTICIPANTS

Argentina

Norberto Ticca, Presidente, Asociación Argentina de Fabricantes de Máquinas Herramientas, Alsina 1609, 6o. piso, Of. 33, 1088 Buenos Aires

Australia

John Anthony Farman, Parktec Int., Parktec International, 483 Adelaide Street, Brisbane 4000, Queensland

Austria

Alfred Mayer, Head, UNIDO Investment Promotion Service, Vienna International Centre, P.O. Box 400, A-1400 Vienna

Belgium

Ginette Colson-Parent, Fonctionnaire, Conseil central de l'économie, avenue de la Joyeuse Entrée 17, B-1040 Brussels

Paul Lamsenz, CRIF, Celestdnenlaan 300 C, 3001 Heverlee

José Libert, Secrétaire général, Conseil central de l'économie, avenue de la Joyeuse Entrée 17, B-1040 Brussels

Methieu Renkin, CECOFORMA, 185, Rue de la Vervie 4100, Seraing

Brazil

Nelson Hitner, Vicepresidente, FRANTO-ABIMAQ, Av. dos Imigrantes 4.80, São Paulo

Chile

Sergio Merino Cisternas, Socio Director, Promotores Internacionales para el Desarrollo Ltda. (PROMINDE), Marin 0124, Santiago

China

Geng Ye, Senior Engineer, Dalian Modular Machine Tool Research Institute, 801 Xinan Road, Beijing

Huang Zhe, Deputy Director and Chief Engineer, The Machine Tool Department, Ministry of Machinery and Electronics Industry, Sanlihe Road, Beijing 100823

Colombia

Henry Delgado, Counsellor, Embassy of Colombia, Pricna 1, Prague 1

Costa Rica

Carlos E. Fernández, Embajador de Costa Rica en Praga, Dlouhá 36, Prague 1

Freddy Valverde, Primer Secretario, Embajada de Costa Rica en Praga, Dlouhá 36, Prague 1

Czechoslovakia

Jiri Bezrouk, Assistant General Director, TOS, Kuřim

Frantisek Blecha, AERO a.s., Berampvych 130, Prague

Vaclav Blecha, R&D Section, Skoda, Plzen

Boris Bortel, Liptovské strojirny, Liptovský Mikuláš

Ivan Capek, Director-General, Strojimport Foreign Trade Co. Ltd., Prague 3

Frantisek Cerha, Deputy Managing Director, INPRO Ltd., Prague 10

Jaroslav Halfar, Tatry Koprivnice

Tibor Haluska, Deputy Director, TOS State Enterprise, Trencin

Josef Hasek, TOS Rakovnik, Prague

Anton Hlavaty, VUNAR, Nové Zámky

Jiri Jandera, Marketing Manager, Pramet, Sumperk

Anton Kajánek, ZVL Kysucké, Nové Mesto na Morave

Petr Kaspárek, Narex a.s., Zdánice

Vojtech Krekac, Deputy Director, State Enterprise, Povazske strojarne, Povazska Bystrica

Pavel Krhánek, Zdárské strojirny

Lubomir Krupa, ESPE Piesok

Kubrová, Strojimport, a.s., Prague

Jaroslav Listik, Commercial Director, INPRO Ltd., Prague

Jiri Marousek, Director, INPRO, Co. Ltd., Prague

Jiri Mudronka, ZKL a.s., Ostrov nad Ohri

Jan Nemec, President, Association of Manufacturers and Suppliers of Engineering Technique, Director, Kovosvit, Sezimovo Isti

Blahoslav Novotny, TOS, Holice

Peter Olejár, TOS, Galanta

Jiri Paloumek, Vice-president, Technoexport, Foreign Trade Co. Ltd., Prague

Milan Pinka, Director, TOS, State Enterprise, Galanta

Vladimir Plhal, Sdruzeni dodavatelu a investicnich celku, Prague

Anton Polácek, Považské strojírny, Povazská Bystrica, Bystrica

Vladimir Rezetka, ZVL Kysucké, Nové Mesto na Morave

Jaroslav Sáda, TOS Hostivar, Prague

Milos Sajbidor, Smeral, Trnava

Martin Schotten, AERO Vodochody, Odolena Voda

Ota Sedlácek, Trading Manager, INPRO Ltd., Prague 10

Zdenek Skarda, ZPS Zlín

Adam Stranák, Technical Director, AERO Vodochody, Odolena Voda

Jiri Stybnar, TOS, Melník

Stanislav Sucansky, Kinex, Bytca

Jaroslav Svoboda, Strojimport a.s., Prague

Josef Vichr, General Manager, TOS Hostivar, State Enterprise, Prague

Pavel Vincar, Marketing Director, Strojimport, Foreign Trade Co. Ltd., Prague

Charvát Zdenek, MEZ, Brno

Anton Zermeg, TOS Celákovice, Prague

Denmark

Niels Brehm, Union Secretary, Dansk Metalarbejdeforbund, Nyropsgade 38, DK-1601 Copenhagen V

Svend Erik Jensen, Group Leader, Metal Industry, Industrikartellet, Nyrupsgade 14, 1602 Copenhagen V

Equatorial Guinea

Aniceto Ebiaca Moete, Director-General Industrias, Ministerio Industrias, Malabo

Ethiopia

Degefu Getachew, Head, Planning and Projects Department, National Metal Works Corporation, P.O. Box 2447, Addis Ababa

France

Christine Brochet, Direction des Nations Unies et des Organisations internationales, Ministère des affaires étrangères, 37 Quai d'Orsay, Paris

Jean R. Chaponnière, IREP, B.P. 47, F-38040 Grenoble

Gerard Fayolle, Ingenieur Commercial, Brisard Machines Outils, 5ème Barrouin, F-42000 Saint Etienne

Joelle Ory, Chargée de mission aux affaires internationales, Ministère de l'industrie et du commerce exterieur, 3-5 rue Barbet de Jouy, Paris

Pierre Padilla, Centre technique des industries mécaniques (CETIM), 52 avenue Félix-Louat, B.P. 67, F-60304 Cedex

Georges Pierron, Secrétaire Général, Centre d'etudes supérieures en electricité, electronique et informatique, 39/41 rue Anatole France, 94300 Vincennes

Bernard Valenduc, Attaché de Direction, Syndicat de la machine-outil, de l'assemblage et de la productique associée, 45 rue Louis Blanc-Cedex 1, 92400 Courbevoie Cedex

Germany

Lothar Hoffmeister, Verein Deutscher Werkzeugmaschinenfabriken, Corneliusstrasse, 6000 Frankfurt 1

Robert Wandel, Ministerial Counsellor, Ministry of Economics, Villemomsklerstrasse D-5300 Bonn 1

Guinea

Moussa Sagno, Chef, Section industrie mécanique, Ministère industrie, B.P. 468, Conakry

India

Harish Chander Gandhi, AB-13, Tilak Marg, New Delhi 110001

Jagdish Pal Malik, General Manager, GM's House, HMT Township, Bangalore

Indonesia

Nugraha Soekmawidjaja, Head, Sub-Directorate for Production Development, Ministry of Industry, Jln. Gatot Subroto Kav. 52-53, Jakarta Selatan

Italy

Elio Pasqualini, Commercial Manager, Flexible Manufacturing Engineering S.p.A., 1 Via Pietro Cossa, 20122 Milan

Republic of Korea

Dong-Chul Kim, Director of Precision Machinery, Ministry of Trade and Industry, Kwacheon Jungang # 1, Kwacheon

Mexico

Porfirio Muñoz Ledo, Segundo Secretario, Misión Permanente de México ante la ONUDI, Türkenstrasse 5, 1090 Vienna, Austria

Myanmar

U Kyi Win, Deputy Superintendent, Myanma Heavy Industries, Union of Myanmar, P.O. Box 370, Kaka Aye, Pagoda Road, Yangon

Netherlands

J.H.P.M. de Brabander, First Commercial Secretary, Embassy of the Netherlands, Malt. Nam., 1 Prague

Peter J.T. van Rens, International Organizations Department, Ministry of Foreign Affairs, Bezuidenhoudsenweg 67, P.O. Box 20061, 2500EB The Hague

Niger

Baraou Baroumge, Direction de l'industrie et de la promotion des investissements privés, Ministère de la promotion économique, B.P. 480, Niamey

Poland

Andrzej Kaniewski, Deputy Director, Machine Tool Exports Division, METALEXPORT, Mokotowska 49, 00-950 Warsaw

Jar Mazurkiewicz, Project Manager, PROMASZ, Barbary 1, 00-950 Warsaw

Tadeusz Olszowski, R&D-Production-Consulting, PONAR Ltd., Barbary 1, 00-950 Warsaw

Romania

Corneliu Gornic, Deputy Director, SIMTEX, S.A., 250, Muncii Blvd., Bucharest

Rwanda

Innocent Ntaganzwa, Chef, Division fiches des grands projects industriels, Ministère de l'industrie et de l'artisanat, B.P. 73, Kigali

Sao Tome and Principe

Jose Cardoso dos Ramos Cassandra. Director del Atelier Central, Dirección de la industria (Atelier Central). Sao Tome

Sudan

Mohamed Osman Abdalla, Deputy General Director, Industrial Research and Consultancy Centre, P.O. Box 268, Khartoum

Sweden

Antonin Petr, General Manager, PPS AB, Fishkamnsgatan 17, 43391 Partille

Thailand

Soodsakorn Putho, Industrial Counsellor, Permanent Mission of Thailand to UNIDO, Weimarerstrasse 68, 1180 Vienna, Austria

Togo

Ladikpo Ayayi Afantonou, Directeur Général de l'unité de production des materiels agricoles (UPROMA), B.P. 111, Kara, Lomé

Uganda

Joatham Kapasi-Kakama, Chief Industrial Officer, Ministry of Industry and Technology, Box 7125, Kampala

United Republic of Tanzania

Masoya Magoti, General Manager, Kilimanjaro Machine Tools Manufacturing Co., Box 90, Moshi

Gallus Msolla, Director General, Tanzania Engineering and Manufacturing Design Organization (TEMDO), P.O. Box 6111, Arusha

Venezuela

Victor Lamas, Vice President, CNV, P.O. Box 61302, Caracas

Rafael A. Padilla-Lovera, Vicepresidente, Instituto de Ingenieria, Apdo. 40200, Caracas 1040A

United Nations Secretariat

United Nations Conference on Trade and Development

Erick Supper, Chief, Industrial Collaboration Section, International Trade Programmes, Palais des Nations, CH-1211 Geneva, Switzerland

Intergovernmental organizations

Centre de Developpement Industriel

Yaya Diarra, Consultant, 28 rue de l'industrie, 1040 Brussels, Belgium

Islamic Development Bank

Muhammad Ahmad, Head, Equity Unit, P.O. Box 5925, Jeddah 21432, Saudi Arabia

Preferential Trade Area for Eastern and Southern African States

John A. Alele Opio, Senior Industrial Expert, Ndeke House Annexe, Haile Selassie Avenue, P.O. Box 300351, Lusaka, Zambia

Annex II

LIST OF DOCUMENTS

Issue paper

Conditions of entry and measures to promote competitive local production and effective utilization of machine tools	ID/WG.514/3

Background documents

The world machine-tool industry	ID/WG.514/4
Conditions of entry into the machine-tool industry and measures to promote competitive local production	ID/WG.514/6

Information documents

Regional study on the machine-tool industry in Asia: The case of India	ID/WG.514/1
The machine-tool industry in Algeria and Tunisia	ID/WG.514/2
The machine-tool industry in the Republic of Korea	ID/WG.514/5
Machine tools in Mexico	ID/WG.508/1(SPEC.)
The machine tool industry and the spread of numerical control in Peru and Bolivia	ID/WG.508/2(SPEC.)
Machine tools in Latin America	ID/WG.508/3(SPEC.)
Supply and demand for machine tools in Latin America, opportunities and policies for co-production projects	ID/WG.508/4(SPEC.)
Co-operation in industrial automation between Argentina and Brazil	ID/WG.508/5(SPEC.)
Report. Regional expert group meeting for Latin America and the Caribbean on the capital goods industry with emphasis on machine tools	ID/WG.508/7(SPEC.)

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